डॉ. शकुन्तला मिश्रा राष्ट्रीय पुनर्वास विश्वविद्यालय, लखनऊ

Dr. Shakuntala Misra National Rehabilitation University, Lucknow

BOARD OF STUDIES

FOR

B. TECH.

(COMPUTER SCIENCE & ENGINEERING)

FACULTY OF ENGINEERING AND TECHNOLOGY

(MINUTES OF MEETING)

(13/12/2019)

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AGENDA

The Board of Studies (BoS) meeting of the Department of Computer Science & Engineering, Faculty of Engineering & Technology is being held in Room No. 229 (Academic Block-1) of Dr. Shakuntala Misra National Rehabilitation University, Lucknow on 13th December 2019.

The following agenda will be discussed:

Agenda No. 1: **Discussion and approval of the Study Evaluation Scheme/Syllabi for B. Tech. Programme.**

Agenda No. 2: **Discussion and approval of admission in first year, maximum 50 % of the total intake will be through UPSEE/JEE mains and the rest admission through University Entrance Examination. The Lateral entry admission to second year will be through UPSEE/JEE mains and against vacant seats through University Entrance Examination.**

Agenda No. 3: **Discussion and approval of paper setters, examiners, members of moderation board and Internal/External practical examiners of End Semester Examination.**

Agenda No. 4: **Any other discussions/suggestions related to the academic development of the University.**

Chairperson
(BoS Committee)

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Board of Studies (BoS) meeting held on 13th December, 2019

Department of Computer Science & Engineering

Faculty of Engineering & Technology

Sl. No.	Members of the BoS	Signature
1.	**Prof. R. K. Srivastava** DSMNRU, Lucknow **Chairperson**	
2.	**Prof. R. K. Singh** DSMNRU, Lucknow **Internal Member**	
3.	**Prof. Sanjay Dwivedi** Baba ShaebBhim Rao Ambedkar University (A Central University), Lucknow **External Member**	

RKS

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MINUTES OF THE BOARD OF STUDIES MEETING HELD ON 13th December, 2019

Department of Computer Science & Engineering

Faculty of Engineering & Technology

Minutes

The Board of Studies (BoS) meeting of the Department of Computer Science & Engineering was held in Room no. 229 (Academic Block-I) on 13th December 2019 at 11:00 AM.

The following members were present:

Internal Members:

1. Prof. R. K. Srivastava - Chairperson
2. Prof. R. K. Singh- Internal Member

External Members:

1. Prof. Sanjay Dwivedi

Prof. R. K. Srivastava, Chairperson (BoS), chaired the meeting and welcomed the external and internal members. He introduced the external members to the internal members. The following agenda items were discussed:

Agenda No. 1: Discussion and approval of the Study Evaluation Scheme/Syllabi for B. Tech. Programme.

The proposed Syllabi and Study Evaluation Scheme of the Department of Computer Science & Engineering was discussed in detail. The BoS Committee subsequently approved the Study Evaluation Scheme/ Syllabi of the concerned department.

Agenda No. 2: Discussion and approval of admission in first year, maximum 50 % of the total intake will be through UPSEE/JEE mains and the rest admission through University Entrance Examination. The Lateral entry admission to second year will be through UPSEE/JEE mains and against vacant seats through University Entrance Examination.

The BoS Committee approved the aforesaid agenda regarding the admission in first year and lateral entry.

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Agenda No. 3: Discussion and approval of paper setters, examiners, members of moderation board and Internal/External practical examiners of End Semester Examination.

The BoS Committee approved the name of paper setters, examiners, members of moderation board and Internal/External practical examiners of End Semester Examination.

Agenda No. 4: Any other discussions/suggestions related to the academic development of the University.

Prof. Sanjay Dwivedi suggested to give emphasis on those subjects which have good acceptance in the industry.

The faculty members of Department of Computer Science & Engineering were also present in the meeting.

At the end, all the proposed agenda concluded with the vote of thanks by the Chairperson.

Chairperson
(BoS Committee)

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डॉ. शकुन्तला मिश्रा राष्ट्रीय पुनर्वास विश्वविद्यालय, लखनऊ

Dr. Shakuntala Misra National Rehabilitation University, Lucknow

BOARD OF STUDIES

FOR

B. TECH.

(COMPUTER SCIENCE & ENGINEERING)

FACULTY OF ENGINEERING AND TECHNOLOGY

(SEMESTER EVALUATION SHEET)

(2019)

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DR. SHAKUNTALA MISRA NATIONAL REHABILITATION UNIVERSITY
FACULTY OF ENGINEERING TECHNOLOGY,
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)

II Year: III Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional Assessment			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	TCS301	Soft Computing	2	0	0	20	10	30	70	100	2
2	TCS302	Web Technology	3	0	0	20	10	30	70	100	3
3	TCS303	Data Structures & Algorithms	3	1	0	20	10	30	70	100	4
4	TES301	Digital Electronics	3	0	0	20	10	30	70	100	3
5	THS302	Industrial Sociology	2	0	0	20	10	30	70	100	2
6	TCS304	Discrete Mathematics	3	1	0	20	10	30	70	100	4
PRACTICAL/DESIGN/DRAWING											
7	TCS351	Soft Computing Lab	0	0	2	0	30	30	70	100	1
8	TCS352	Web Technology Lab	0	0	2	0	30	30	70	100	1
9	TCS 353	Data Structures Lab	0	0	2	0	30	30	70	100	1
10	TES351	Digital Electronics Lab	0	0	2	0	30	30	70	100	1
		Total	16	2	8					1000	22

L- Lecture
T -Tutorial
P-Practical
MST- Mid Semester Test
TA-Teacher's Assessment
SEE- Semester End Examination

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DR. SHAKUNTALA MISRA NATIONAL REHABILITATION UNIVERSITY
FACULTY OF ENGINEERING TECHNOLOGY,
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)

II Year: IV Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	TCS401	Operating System	3	0	0	20	10	30	70	100	3
2	TCS402	Design & Analysis of Algorithms	3	1	0	20	10	30	70	100	4
3	TCS403	Database Management System	3	0	0	20	10	30	70	100	3
4	TCS404	Computer Organisation & Architecture	3	0	0	20	10	30	70	100	3
5	THS401	Effective Technical Communication	2	0	0	20	10	30	70	100	2
6	TBS402	Engineering Mathematics-III	3	0	0	20	10	30	70	100	3
PRACTICAL/DESIGN/DRAWING											
7	TCS451	Operating System Lab	0	0	2	0	30	30	70	100	1
8	TCS452	Design & Analysis of Algorithm Lab	0	0	2	0	30	30	70	100	1
9	TCS453	Database Management System Lab	0	0	2	0	30	30	70	100	1
10	TCS454	Computer Organisation & Architecture	0	0	2	0	30	30	70	100	1
		Total	17	1	8					1000	22

L- Lecture
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DR. SHAKUNTALA MISRA NATIONAL REHABILITATION UNIVERSITY
FACULTY OF ENGINEERING TECHNOLOGY,
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)

III Year: V Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	TCS501	Artificial Intelligence	3	1	0	15	15	30	70	100	4
2	TCS502	Object Oriented Programming with Java	3	1	0	15	15	30	70	100	4
3	TCS503	Software Engineering	3	0	0	15	15	30	70	100	3
4	TCS504	Computer Graphics	3	0	0	15	15	30	70	100	3
5	TCS505	Formal Language & Automata Theory	3	1	0	15	15	30	70	100	4
6	TMC502	Constitution of India	2	0	0	15	15	30	70	100	0
PRACTICAL/DESIGN/DRAWING											
7	TCS551	Artificial Intelligence	0	0	2	0	30	30	70	100	1
8	TCS552	Object Oriented Programming Lab	0	0	2	0	30	30	70	100	1
9	TCS553	Software Engineering Lab	0	0	2	0	30	30	70	100	1
10	TCS554	Computer Graphics Lab	0	0	2	0	30	30	70	100	1
		Total	17	3	6					1000	22

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DR. SHAKUNTALA MISRA NATIONAL REHABILITATION UNIVERSITY
FACULTY OF ENGINEERING TECHNOLOGY,
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)

III Year: VI Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	TCS601	Computer Networks	3	0	0	20	10	30	70	100	3
2	TCS602	Compiler Design	3	1	0	20	10	30	70	100	4
3	TCS603	Python Programming	3	0	0	20	10	30	70	100	3
4	TCS604	Neural Network & Deep Learning	3	0	0	20	10	30	70	100	3
5	TCS061 - 064	Departmental Elective –I	3	0	0	20	10	30	70	100	3
6	THS601	Engineering Economics	2	0	0	20	10	30	70	100	2
PRACTICAL/DESIGN/DRAWING											
7	TCS651	Computer Networks Lab	0	0	2	0	30	30	70	100	1
8	TCS652	Compiler Design Lab	0	0	2	0	30	30	70	100	1
9	TCS653	Python Programming Lab	0	0	2	0	30	30	70	100	1
10	TCS654	Seminar	0	0	6	0	100	100	0	200	1
		Total	17	1	12					1000	22

The Summer Training (5-6 weeks) conducted during summer break after VI semester and will be assessed during VII Semester

Departmental Elective –I		
1	TCS061	Data Sciences
2	TCS062	Distributed System
3	TCS063	Data Mining and Warehousing
4	TCS064	Machine Learning

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FACULTY OF ENGINEERING TECHNOLOGY,

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)

IV Year: VII Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	TCS701	Digital Image Processing	3	1	0	20	10	30	70	100	4
2	OE071-074	Open Elective - I	3	0	0	20	10	30	70	100	3
3	TCS071 - 074	Departmental Elective-II	3	0	0	20	10	30	70	100	3
4	TCS075 - 078	Departmental Elective-III	3	0	0	20	10	30	70	100	3
PRACTICAL/DESIGN/DRAWING											
5	TCS751	Digital Image Processing Lab	0	0	2	0	30	30	70	100	1
6	TCS752	Industrial Training	0	0	2	0	30	30	70	100	1
7	TCS753	Project - II	0	0	10	0	400	400	0	400	5
		Total	12	1	14					1000	20

Open Elective - I

1	TOE071	Renewable Energy Sources Development Technology
2	TOE072	Global Positioning System and its Applications
3	TOE073	Data Base Management System and Data Mining
4	TOE074	Introduction To Robotics& Bionics
5	TOE075	Entrepreneurship Development
6	TOE076	Quality Management

Departmental Elective –II

1	TCS071	Quantum Computing
2	TCS072	Embedded System
3	TCS073	Speech and Natural Language Processing
4	TCS074	Cloud Computing

Departmental Elective –III

1	TCS075	Internet of Things (IoT)
2	TCS076	Cluster Computing
3	TCS077	Parallel Algorithm
4	TCS078	Human Computer Interaction

L- Lecture

T -Tutorial

P-Practical

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DR. SHAKUNTALA MISRA NATIONAL REHABILITATION UNIVERSITY

FACULTY OF ENGINEERING TECHNOLOGY,

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)

IV Year: VIII Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	OE081-084	Open Elective - II/MOOCs	3	0	0	20	10	30	70	100	3
2	TCS081 - 084	Elective-IV/MOOCs	3	0	0	20	10	30	70	100	3
3	TCS085 - 088	Elective-V/MOOCs	3	0	0	20	10	30	70	100	3
PRACTICAL/DESIGN/DRAWING											
5	TCS851	Project - II	0	0	18	0	700	700	0	700	9
		Total	9	0	18					1000	18
Massive Open Online Course (MOOC)		The students can register for these courses through NPTEL directlty as per the course offering in Odd/Even Semester at NPTEL. After successful completion of these Moocs course the students, shall, provide their successful completion NPTEL certificate to the Department.									

Open Elective - II

1	TOE081	Disaster Management
2	TOE082	Cloud Computing
3	TOE083	Project Management
4	TOE084	Operation Research
5	TOE085	Introduction to Bio-Technology
6	TOE086	Small Hydro Power Development

Departmental Elective –IV

1	TCS081	Cryptography & Network Security
2	TCS082	Real Time System
3	TCS083	Pattern Recognition
4	TCS084	Service Oriented

Departmental Elective –V

1	TCS085	Semantic Web and Web Services
2	TCS086	Big Data
3	TCS087	Blockchain
4	TCS088	Virtual Reality

L- Lecture

T -Tutorial

P-Practical

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डॉ. शकुन्तला मिश्रा राष्ट्रीय पुनर्वास विश्वविद्यालय, लखनऊ

Dr. Shakuntala Misra National Rehabilitation University, Lucknow

BOARD OF STUDIES

FOR

B. TECH.

(COMPUTER SCIENCE & ENGINEERING)

FACULTY OF ENGINEERING AND TECHNOLOGY

(SYLLABI)

(2019)

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PROGRAMMING FOR PROBLEM SOLVING

(TES101/TES201)

Unit	Topic
I	Introduction to components of a computer system: Memory, processor, I/O Devices, storage, operating system, Concept of assembler, compiler, interpreter, loader and linker. Idea of Algorithm: Representation of Algorithm, Flowchart, Pseudo code with examples, From algorithms to programs, source code. Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language. Standard I/O in C, Fundamental data types, Variables and memory locations, Storage classes.
II	Arithmetic expressions and precedence: Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associativity. Conditional Branching: Applying if and switch statements, nesting if and else, use of break and default with switch.
III	Iteration and loops: Use of while, do while and for loops, multiple loop variables, use of break and continue statements. Functions: Introduction, types of functions, functions with array, passing parameters to functions, call by value, call by reference, recursive functions.
IV	Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays. Character arrays and strings, Structure, Union, Enumerated data types, Array of structures, Passing arrays to functions.
V	Pointers: Introduction, declaration, applications, Introduction to dynamic memory allocation (malloc, calloc, realloc, free), Use of pointers in self-referential structures, notion of linked list. File handling: File I/O functions, Standard C preprocessors, defining and calling macros, command-line arguments.

Text/ Reference Books:

(i) Schum"s Outline of Programming with C by Byron Gottfried, McGraw-Hill

(ii) The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education.

(iii) Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited, 2015.

(iv) Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House

(v) Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill

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PROGRAMMING FOR PROBLEM SOLVING LAB

(TES151/TES251)

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.

2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard.

3. WAP to calculate the area and circumference of a circle.

4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F-32)/9.

5. WAP that swaps values of two variables using a third variable.

6. WAP that checks whether the two numbers entered by the user are equal or not.

7. WAP to find the greatest of three numbers.

8. WAP that finds whether a given number is even or odd.

9. WAP that tells whether a given year is a leap year or not.

10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria: Between 90-100%----------Print „A" 80-90%---------- Print „B" 60-80%----------Print „C" Below 60%----------Print „D"

11. WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.

12. WAP to print the sum of all numbers up to a given number.

13. WAP to find the factorial of a given number.

14. WAP to print sum of even and odd numbers from 1 to N numbers.

15. WAP to print the Fibonacci series.

16. WAP to check whether the entered number is prime or not.

17. WAP to find the sum of digits of the entered number.

18. WAP to find the reverse of a number. 19. WAP to print Armstrong numbers from 1 to 100.

20. WAP to convert binary number into decimal number and vice versa. Other Reference: - 1. Use C Open Source Software referring Spoken Tutorial MOOC

21. WAP that simply takes elements of the array from the user and finds the sum of these elements.

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22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.

23. WAP to find the minimum and maximum element of the array.

24. WAP to search an element in a array using Linear Search.

25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.

26. WAP to add and multiply two matrices of order nxn.

27. WAP that finds the sum of diagonal elements of a mxn matrix.

28. WAP to implement strlen (), streat (),strcpy () using the concept of Functions.

29. Define a structure data type TRAIN_INFO. The type contain Train No.: integer type Train name: string Departure Time: aggregate type TIME Arrival Time: aggregate type TIME Start station: string End station: string The structure type Time contains two integer members: hour and minute. Maintain a train timetable and implement the following operations: (i) List all the trains (sorted according to train number) that depart from a particular section. (ii) List all the trains that depart from a particular station at a particular time. (iii) List all he trains that depart from a particular station within the next one hour of a given time. (iv) List all the trains between a pair of start station and end station.

30. WAP to swap two elements using the concept of pointers.

31. WAP to compare the contents of two files and determine whether they are same or not.

32. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

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DR. SHAKUNTALA MISRA NATIONAL REHABILITATION UNIVERSITY
FACULTY OF ENGINEERING TECHNOLOGY,
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)

II Year: III Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional Assessment			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	TCS301	Soft Computing	2	0	0	20	10	30	70	100	2
2	TCS302	Web Technology	3	0	0	20	10	30	70	100	3
3	TCS303	Data Structures & Algorithms	3	1	0	20	10	30	70	100	4
4	TES301	Digital Electronics	3	0	0	20	10	30	70	100	3
5	THS302	Industrial Sociology	2	0	0	20	10	30	70	100	2
6	TCS304	Discrete Mathematics	3	1	0	20	10	30	70	100	4
PRACTICAL/DESIGN/DRAWING											
7	TCS351	Soft Computing Lab	0	0	2	0	30	30	70	100	1
8	TCS352	Web Technology Lab	0	0	2	0	30	30	70	100	1
9	TCS 353	Data Structures Lab	0	0	2	0	30	30	70	100	1
10	TES351	Digital Electronics Lab	0	0	2	0	30	30	70	100	1
		Total	16	2	8					1000	22

L- Lecture
T -Tutorial
P-Practical
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TA-Teacher's Assessment
SEE- Semester End Examination

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SOFT COMPUTING
(TCS301)

Unit	Topic
I	**Neural Networks-I(Introduction & Architecture):** Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks.Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.
II	**Neural Networks-II (Back propogation networks):** Architecture perceptron model, solution, single layer artificial neural network, multilayer perception model; back propogation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.
III	**Fuzzy Logic-I (Introduction)** Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.
IV	**Fuzzy Logic –II (Fuzzy Membership, Rules):** Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.
V	**Genetic Algorithm(GA)** Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

Text Book (s):

1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India.
2. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.

Reference Books:

3. Siman Haykin,"Neural Netowrks"Prentice Hall of India
4. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
5. Kumar Satish, "Neural Networks" Tata Mc Graw Hill

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WEB TECHNOLOGY
(TCS302)

Unit	Topic
I	**Introduction to Web Technology:** Internet, WWW, Web Browsers with suitable examples , Web Servers with suitable examples, URL, HTTP, MIME. Introduction to HTML& DHTML : Basic Syntax, HTML Document Structure , Text Formatting, Images, Lists, Links, Tables, Frames, Forms, Cascade Style Sheets : Levels Of Style Sheets, Specification Formats, Style Classes , Properties, Colors, Span and Div tags.
II	**Introduction to Java Script:** Overview of java Script, Syntactic characteristics, Primitives, Operator and Expression, control statements, Arrays, functions, errors in scripts, Document Object Model(DOM),Event driven computation, element access in Java script, The navigator Object. Dynamic Document with Java Script : Element positioning, Moving elements, Changing colors and fonts, Dynamic content, Locating the mouse Cursor, Slow movements of elements, Dragging and Dropping Elements.
III	**Introduction to XML:** Syntax of XML, Document Structure, Document type definition, Namespaces,XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX.
IV	**Introduction to PHP:** Overview of PHP, general server characteristics, Creating PHP Pages, Form handling , Data Base access with PHP & MySql. JSP & Servlets: Basics of JSP, Tags, Session Handling, Redirection and Basics of Servlet
V	**Database Connectivity:** Connection to various databases (MySQL, Oracle), Database connectivity in PHP, JSP, Other server languages, Basic SQL Queries and Statements.

Text Book (s):

1. Programming world wide web- Robert W.Sebesta , Pearson.
2. Beginners PHP, Apache, MY Sql, Web Development, by Michael Glass, Wrox.

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DATA STRUCTURES & ALGORITHMS
(TCS303)

Unit	Topic
I	**Introduction:** Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. **Searching:** Linear Search and Binary Search Techniques and their complexity analysis.
II	**Stacks and Queues:** ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.
III	**Linked Lists:** Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.
IV	**Trees:** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.
V	**Sorting and Hashing:** Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. **Graph:** Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Text Book (s):

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni. Computer Science Press.
2. "Data Structures", RS Salaria, Khanna Publishing House
3. How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.

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DIGITAL ELECTRONICS
(TES301)

Unit	Topic
I	**Fundamentals of Digital Systems and logic families:** Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-statelogic.
II	**Combinational Digital Circuits** Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De- Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.
III	**Sequential circuits and systems** A 1-bit memory, the circuit properties of Bi stable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC' s, asynchronous sequential counters, applications of counters..
IV	**A/D and D/A Converters:** Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs
V	**Semiconductor memories and Programmable logic devices.** Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA)..

Text Book (s):

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016..

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Industrial Sociology

Course Code: THS- 302/THS-402

Unit	Contents	No. of Hrs.
I	Descriptors/Topics **Industrial Sociology:** Nature, Scope and Importance, Origin and Development, Industry as a social system, Evolution of Working Class , Changing nature of work , Growth of unorganized informal sector. Dynamics of Industrial Relations: Approaches to the study of Industrial Relations, Collective Bargaining – Concepts, Types, Scope and Importance.	12
II	**Industrial Disputes:** Concept, Features and Kinds of disputes, Settling disputes, Mediation, Arbitration, Conciliation, Negotiation.	8
III	Descriptors /Topics **Trade Union:** Concept, Features, Functions and Types, History of Trade Union Movement in India, Trade Unions and Challenges of Privatization and Globalization, Law and work, Decline of Trade Unions.	10
IV	**Dynamics of Industrial Relations:** Corporate Social Responsibility, Inclusion of Women in the Corporate Sector, Scope of Industrial Sociology in India, Impact on Employment, Impact on HRD, Impact on wages and benefits, Modern Industry in India – Development of Industry in Post-Independence period, The Indian Worker: Features of Indian worker, The contribution of Social - Philosophy, family, caste and community in determining the attitude of workers.	10

References:

1. PREMVIR KAPOOOR, Sociology & Economics for Engineers, Khanna Publishing House (Edition 2018).

2. GISBERT PASCAL, Fundamentals of Industrial sociology, Tata McGraw Hill, New Delhi, 1972.

3. MAMORIA C.B. And MAMORIA S., Dynamics of Industrial Relations in India.

4. SINHA G.P. and P.R.N. SINHA, Industrial Relations and Labour Legislations, New Delhi, Oxford and IBH Publishing Co., 1977.

5. S.C. SHARMA, Industrial Safety and Health Management, Khanna Book Publishing Co. (P) Ltd., Delhi (ISBN: 978-93-86173-188

13/12/19 13/12/19

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DISCRETE MATHMATICS
(TCS304)

Unit	Topic
I	**Sets, relations and functions:** Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.
II	**Propositional Logic:** Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, deduction theorem, etc. Decision problems of propositional logic. Introduction to first order logic and first order theory. **Partially ordered sets:** Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices. Boolean and pseudo Boolean lattices.
III	**Algebraic Structures:** Algebraic structures with one binary operation – semigroup, monoid and group. Cosets, Lagrange's theorem, normal subgroup, homomorphic subgroup. Congruence relation and quotient structures. Error correcting code. Algebraic structures with two binary operations- ring, integral domain, and field. Boolean algebra and boolean ring (Definitions and simple examples only).
IV	**Introduction to Counting:** Basic counting techniques - inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions.
V	**Introduction to Graphs:** Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, trees.

Text Book (s):

1. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill.
2. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific.
3. T. Veerarajan, "Discrete Mathematics", Tata McGraw-Hill
4. K. H. Rosen, Discrete Mathematics and its Applications, 6th Ed., Tata McGraw-Hill.
5. J. L. Hein, Discrete Structures, Logic, and Computability, 3rd Ed., Jones and Bartlett.
6. N. Deo, Graph Theory, Prentice Hall of India.
7. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill.
8. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill.

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SOFT COMPUTING LAB
(TCS351)

LIST OF EXPERIMENTS

1. Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.
2. Create a simple ADALINE network with appropriate no. of input and output nodes. Train it using delta learning rule until no change in weights is required. Output the final weights.
3. Train the autocorrelator by given patterns: A1=(-1,1,-1,1), A2=(1,1,1,-1), A3=(-1, -1, - 1, 1). Test it using patterns: Ax=(-1,1,-1,1), Ay=(1,1,1,1), Az=(-1,-1,-1,-1).
4. Train the hetrocorrelator using multiple training encoding strategy for given patterns: A1=(000111001) B1=(010000111), A2=(111001110) B2=(100000001), A3=(110110101) B3(101001010). Test it using pattern A2
5. Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform maxmin composition on any two fuzzy relations.
6. Solve Greg Viot's fuzzy cruise controller using MATLAB Fuzzy logic toolbox.
7. Solve Air Conditioner Controller using MATLAB Fuzzy logic toolbox.
8. Implement TSP using GA.

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WEB TECHNOLOGY LAB
(TCS352)

LIST OF EXPERIMENTS

1. Write a program in HTML to display different styles of heading text.
2. Write a program to display the processes to be followed for a patient when he enters for a complete check-up. Use ordered lists and unordered lists.
3. Write a program to display a traditional Newspaper with the use of table tags.
4. With the help of "IMAGE" tags write a program to display the image along with some contents.
5. Use "Anchor" tag to write a program for displaying various Menus.
6. Use mapping technique, to map a particular part of image and move the control corresponding to that area. For e.g., in an image, if there are bat, ball, stump etc. When you click stump control should move to a file call St.htm.
7. Create frames that have details about various cities.
8. Create a form to display the kinds of food available in a Restaurant. (Use checkboxes wherever necessary)
9. Write a program to "reload" a page automatically once in 5 seconds.
10. Write a program using CSS to set the background colour, font, and paragraph.

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DATA STRUCTURE USING C LAB
(TCS353)

LIST OF EXPERIMENTS

1. Sorting Algorithms-Non-Recursive.
2. Sorting Algorithms-Recursive.
3. Searching Algorithm.
4. Implementation of Stack using Array.
5. Implementation of Queue using Array.
6. Implementation of Circular Queue using Array.
7. Implementation of Stack using Linked List.
8. Implementation of Queue using Linked List.
9. Implementation of Circular Queue using Linked List.
10. Implementation of Tree Structures, Binary Tree, Tree Traversal, Binary Search Tree, Insertion and Deletion in BST.
11. Graph Implementation, BFS, DFS, Minimum cost spanning tree, shortest path algorithm.

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DIGITAL ELECTRNOICS LAB

(TES351)

List of Experiments

1. To verify the truth tables of basic logic gates: AND, OR, NOR, NAND. Also to verify the truth table of Ex-OR, Ex-NOR (For 2, 3, & 4 inputs using gates).
2. To realization of OR, AND, NOR, Ex-OR, Ex-NOR using NAND & NOR gates.
3. To realize an SOP and POS expression.
4. To realize Half adder/ Subtractor& Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables
5. To realize a 4-bit ripple adder/ Subtractor using basic Half adder/ Subtractor& basic Full Adder/ Subtractor.
6. To verify the truth table of 4-to-1 multiplexer and 1-to-4 multiplexer. Realize the multiplexer using basic gates only. Also to construct and 8-to-1 multiplexer and 1-to-8 demultiplexer using blocks of 4-to-1 multiplexer and 1-to-4 demultiplexer
7. Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -312 seven-segment display
8. Using basic logic gates, realize the R-S, J-K and D-flip flops with and without clock signal and verify their truth table.
9. Construct a divide by 2, 4 & 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.
10. Perform input/output operations on parallel in/Parallel out and Serial in/Serial out registers using clock. Also exercise loading only one of multiple values into the register using multiplexer.

Note: As far as possible, the experiments shall be performed on bread board. However experiment Nos. 1-4 are to be performed on bread board only

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DR. SHAKUNTALA MISRA NATIONAL REHABILITATION UNIVERSITY

FACULTY OF ENGINEERING TECHNOLOGY,

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)

II Year: IV Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	TCS401	Operating System	3	0	0	20	10	30	70	100	3
2	TCS402	Design & Analysis of Algorithms	3	0	0	20	10	30	70	100	3
3	TCS403	Database Management System	3	0	0	20	10	30	70	100	3
4	TCS404	Computer Organisation & Architecture	3	0	0	20	10	30	70	100	3
5	THS401	Effective Technical Communication	2	0	0	20	10	30	70	100	2
6	TBS402	Engineering Mathematics-III	3	1	0	20	10	30	70	100	4
PRACTICAL/DESIGN/DRAWING											
7	TCS451	Operating System Lab	0	0	2	0	30	30	70	100	1
8	TCS452	Design & Analysis of Algorithm Lab	0	0	2	0	30	30	70	100	1
9	TCS453	Database Management System Lab	0	0	2	0	30	30	70	100	1
10	TCS454	Computer Organisation & Architecture	0	0	2	0	30	30	70	100	1
		Total	17	1	8					1000	22

L- Lecture
T -Tutorial
P-Practical
MST- Mid Semester Test
TA-Teacher's Assessment
SEE- Semester End Examination

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OPERATING SYSTEM
(TCS-401)

Unit	Topic
I	**Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.
II	**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, **Process Scheduling:** Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.
III	**Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson' s Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader' s & Writer Problem, Dinning Philosopher Problem etc. **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker' s algorithm, Deadlock detection and Recovery.
IV	**Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation - Fixed and variable partition-Internal and External fragmentation and Compaction; Paging: Principle of operation - Page allocation - Hardware support for paging, Protection and sharing, Disadvantages of paging. **Virtual Memory:** Basics of Virtual Memory - Hardware and control structures - Locality of reference, Page fault , Working Set , Dirty page/Dirty bit - Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).
V	**I/O Hardware:** I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms **File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. **Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

Text Book (s) :

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts, John Wiley.
2. William Stallings, Operating Systems: Internals and Design Principles. PHI,
3. Dhananjay M. Dhamdhere, "Operating Systems A Concept-Based Approach", TMH

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DESIGN & ANALYSIS OF ALGORITHMS
(TCS402)

Unit	Topic
I	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.
II	Fundamental Algorithmic Strategies: Brute-Force, Greedy,Dynamic Programming, Branchand- Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving , Bin Packing, Knap Sack TSP. Heuristics - characteristics and their application domains.
III	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.
IV	Tractable and Intractable Problems: Computability of Algorithms, Computability classes - P, NP, NP-complete and NP-hard. Cook' s theorem, Standard NP-complete problems and Reduction techniques.
V	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Text Book (s):

1. Introduction to Algorithms, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.
3. Design & Analysis of Algorithms, S. Sridhar, Oxford
4. Design & Analysis of Algorithms, Sharma, Khanna Publishing House, N.Delhi

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DATABASE MANAGEMENT SYSTEM
(TCS403)

Unit	Topic
I	**Database system architecture:** Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). **Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.
II	**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. **Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. **Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.
III	**Storage strategies:** Indices, B-trees, hashing. **Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.
IV	**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.
V	**Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Book (s):

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.

3. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education

4. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

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COMPUTER ORGANIZATION &ARCHITECTURE
(TCS404)

Unit	Topic
I	**Functional blocks of a computer:** CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs. **Data representation:** signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.
II	**Introduction** to x86 architecture. **CPU control unit design:** hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU. **Memory system design:** semiconductor memory technologies, memory organization.
III	**Peripheral devices and their characteristics:** Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces - SCII, USB
IV	**Pipelining:** Basic concepts of pipelining, throughput and speedup, pipeline hazards. **Parallel Processors:** Introduction to parallel processors, Concurrent access to memory and cache coherency.
V	**Memory organization:** Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Book (s):

1. "Computer Organization & Architecture", Rajaraman, PHI Learning
2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

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Effective Technical Communication

THS-301/THS-401

Unit	Contents	No. of Hrs.
I	**Dynamics of Communication** Definition and process, Kinesics, Proxemics, Paralinguistic features, Importance of Interpersonal and Intercultural Communication in todays organizations, Factors affecting information and document design, information design and writing for print and for online media.	6
II	**Technical Writing** Report writing, Technical proposal, Technical description, Business letters(sales, order, complaint, adjustment, inquiry, recommendation, appreciation, apology, acknowledgement, cover letter), Agenda of meeting, Minutes of meeting, Resume writing .	10
III	**Technical Communication** Public speaking, Group discussion, Presentation strategies, Interview skills, Negotiation skills, Critical and Creative thinking in communication .	8
IV	**Ethics in Engineering** Scope of engineering ethics, Accepting and sharing responsibility, Responsible professionals and ethical corporations ,Resolving ethical dilemmas, Making moral choices, intellectual property rights, plagiarism.	8
V	**Etiquettes** Telephone etiquettes, Etiquettes for foreign business trips, Visits of foreign counterparts, Etiquettes for small talks, Respecting privacy, Learning to say NO, Time management .	8

Reference Books

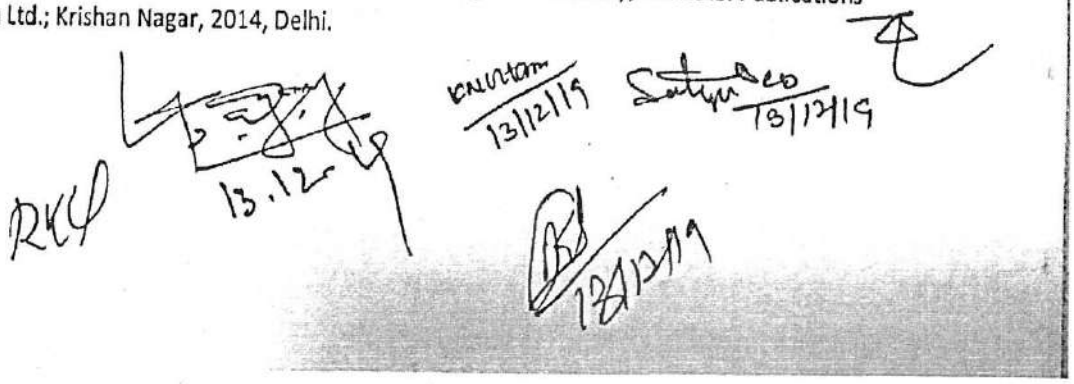
1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.

2. Personality Development and Soft Skills by Barun K. Mitra, OUP, 2012, New Delhi.

3. Spoken English- A Manual of Speech and Phonetics by R.K.Bansal & J.B.Harrison, Orient Blackswan, 2013, New Delhi.

4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.

5. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.



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Engineering Mathematics III

TBS –302/402

Unit	Topic	Contact Hours
I	**Complex Variable – Differentiation:** Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.	9
II	**Complex Variable – Integration:** Contour integrals, Cauchy-Goursat's theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integrals involving sine and cosine functions.	8
III	**Probability and Statistics:** Definition of probability and simple theorems, Conditional probability, Baye's theorem, Random Variables, discrete and continuous distributions, Binomial, Poisson and Normal distributions, correlation and linear regression.	9
IV	**Numerical Methods:** Solution of polynomial and transcendental equations– Bisection method, Newton-Raphson method,Regula-Falsi method, Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae, Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.	8
V	**Numerical Methods:** Euler and modified Euler's methods for solving ordinary differential equations. Runge- Kutta method of fourth order for solving first and second order differential equations. Milne's and Adam's predicator corrector methods.	9

Text/ Reference Books:

1. E. Balagurusamy : Numerical Methods, Tata Mc Graw Hill, 2008.
2. Devi Prasad: An introduction to Numerical analysis, Narosa Publishing House, 2006.
3. J. B. Conway: Functions of one complex variable, springer verlag, international student Edition Narosa Publishing House, 1980.
4. A. M. Goon, M. K. Gupta and B. Das Gupta: basic Statistics, The word PrenPvt. Ltd., Calculta, 1991.
5. L. V. Ahlfors: Complex analysis, Tata McGraw Hill, 1979.

13/12/19 13/12/19 13/12/19

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OPERATING SYSTEM LAB
(TCS451)

LIST OF EXPERIMENTS

1. Study of hardware and software requirements of different operating systems (UNIX,LINUX,WINDOWS XP, WINDOWS7/8

2. Execute various UNIX system calls for
i. Process management ii. File management iii. Input/output Systems calls

3. Implement CPU Scheduling Policies:
i. SJF ii. Priority iii. FCFS iv. Multi-level Queue

4. Implement file storage allocation technique:
i. Contiguous(using array)
ii. Linked –list(using linked-list)
iii. Indirect allocation (indexing)

5. Implementation of contiguous allocation techniques:
i. Worst-Fit ii. Best- Fit iii. First- Fit

6. Calculation of external and internal fragmentation
i. Free space list of blocks from system ii. List process file from the system

7. Implementation of compaction for the continually changing memory layout and calculate total movement of data

8. Implementation of resource allocation graph RAG)

9. Implementation of Banker's algorithm

10. Conversion of resource allocation graph (RAG) to wait for graph (WFG) for each type of method used for storing
graph.

11. Implement the solution for Bounded Buffer (producer-consumer)problem using inter process communication techniques-Semaphores.

12. Implement the solutions for Readers-Writers problem using inter process communication technique –Semaphore.

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DESIGN & ANALYSIS OF ALGORITHM LAB
(TCS452)

LIST OF EXPERIMENTS

1. Implementation of Quick Sort and Merge Sort.
2. Implementation of Linear-time Sorting Algorithms.
3. Implementation of Red-Black Tree operations.
4. Implementation of Binomial Heap operations.
5. Implementation of an application of Dynamic Programming.
6. Implementation of an application of Greedy Algorithm.
7. Implementation of Minimum Spanning Tree Algorithm.
8. Implementation of Single-pair shortest path Algorithm.
9. Implementation of All-pair shortest path Algorithm.
1. Implementation of String Matching Algorithm.

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DATABASE MANAGEMENT SYSTEM LAB
(TCS453)

LIST OF EXPERIMENTS

1. Write the queries for Data Definition and Data Manipulation Language.
2. Write SQL queries using logical operators.
3. Write SQL queries using SQL operators
4. Write SQL query using character, number, date and group functions
5. Write SQL queries for relational algebra
6. Write SQL queries for extracting data from more than one table
7. Write SQL queries for sub queries, nested queries
8. Write program of PL/SQL
9. Concepts for ROLL BACK, COMMIT & CHECK POINTS
10. Create VIEWS, CURSORS and TRGGERS.

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COMPUTER ORGANIZATION &ARCHITECTURE LAB

(TCS454)

1. Implementing HALF ADDER, FULL ADDER using basic logic gates
2. Implementing Binary -to -Gray, Gray -to -Binary code conversions.
3. Implementing 3-8 line DECODER.
4. Implementing 4x1 and 8x1 MULTIPLEXERS.
5. Verify the excitation tables of various FLIP-FLOPS.
6. Design of an 8-bit Input/ Output system with four 8-bit Internal Registers.
7. Design of an 8-bit ARITHMETIC LOGIC UNIT.
8. Design the data path of a computer from its register transfer language description.
9. Design the control unit of a computer using either hardwiring or microprogramming based on its register transfer language description.
10. Implement a simple instruction set computer with a control unit and a data path.

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DR. SHAKUNTALA MISRA NATIONAL REHABILITATION UNIVERSITY

FACULTY OF ENGINEERING TECHNOLOGY,

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)

III Year: V Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	TCS501	Artificial Intelligence	3	1	0	15	15	30	70	100	4
2	TCS502	Object Oriented Programming with Java	3	1	0	15	15	30	70	100	4
3	TCS503	Software Engineering	3	0	0	15	15	30	70	100	3
4	TCS504	Computer Graphics	3	0	0	15	15	30	70	100	3
5	TCS505	Formal Language & Automata Theory	3	1	0	15	15	30	70	100	4
6	TMC502	Constitution of India	2	0	0	15	15	30	70	100	0
PRACTICAL/DESIGN/DRAWING											
7	TCS551	Artificial Intelligence	0	0	2	0	30	30	70	100	1
8	TCS552	Object Oriented Programming Lab	0	0	2	0	30	30	70	100	1
9	TCS553	Software Engineering Lab	0	0	2	0	30	30	70	100	1
10	TCS554	Computer Graphics Lab	0	0	2	0	30	30	70	100	1
		Total	17	3	6					1000	22

L- Lecture

T -Tutorial

P-Practical

MST- Mid Semester Test

TA-Teacher's Assessment

SEE- Semester End Examination

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ARTIFICIAL INTELLIGENCE
(TCS501)

Objective: Artificial Intelligence is a major step forward in how computer system adapts, evolves and learns. It has widespread application in almost every industry and is considered to be a big technological shift, similar in scale to past events such as the industrial revolution, the computer age, and the smart phone revolution.

Unit	Topic
I	**Introduction:** Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.
II	**Search Algorithms:** Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.
III	**Probabilistic Reasoning:** Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.
IV	**Markov Decision:** MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.
V	**Reinforcement Learning:** Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

References:

1. Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing, PHI
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications, PHI
3. George F Luger, Artificial Intelligence. Structures and Strategies for Complex Problem Solving, Addison-Wesley
4. Ben Coppier, Artificial Intelligence Illuminated, Narosa

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OBJECT ORIENTED PROGRAMMING WITH JAVA
(TCS502)

Objective: The goal of subject is to provide the students a broad exposure to the advance object oriented programming field in order to be prepared for follow-on study.

Unit	Topic
I	Java Basics History of Java, Java buzzwords, datatypes, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and costing, simple java program, classes and objects – concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, string handling.
II	Packages and Interfaces : Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces. Exploring packages – Java.io, java.util. Exception handling and multithreading – Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes. Differences between multi threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.
III	Event Handling : Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes, inner classes.The AWT class hierarchy, user interface components- labels, button, canvas, scrollbars, text components, check box, check box groups, choices, lists panels – scrollpane, dialogs, menubar, graphics, layout manager – layout manager types – boarder, grid, flow, card and grib bag.
IV	Applets – Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating applets, passing parameters to applets. Swing – Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JApplet, JFrame and JComponent, Icons and Labels, text fields, buttons – The JButton class, Check boxes, Radio buttons, Combo boxes, Tabbed Panes, Scroll Panes, Trees, and Tables.
V	Networking – Basics of network programming, addresses, ports, sockets, simple client server program, multiple clients, Java .net package, Web Servers and Servlets: Tomcat web server, Introduction to Servelets: Lifecycle of a Serverlet, Web Server operations, general server characteristics, Security Issues, Structure of Web Application, Deploying Web Application, Introduction to Model View Controller (MVC) Architecture, its structure, components.

References:

1. Java; the complete reference, Herbert schildt, TMH, 2011
2. Understanding OOP with Java, updated edition, T. Budd, pearson education, 2000.
3. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John wiley & sons, 2001.

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SOFTWARE ENGINEERING
(TCS503)

Objective: The course is aimed at enhancing skills that will enable the student to develop business software's that are simple reliable and capable of modification as per requirement.

Unit	Topic
I	Introduction to Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes. Software Development Life Cycle (SDLC) Models: Water Fall Model, Prototype Model, Spiral Model, Evolutionary Development Models, Iterative Enhancement Models.
II	Software Requirement Specifications (SRS). Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS. Software Quality Attributes, Software Quality Assurance (SQA): Verification and Validation, SQA Plans, Software Quality Frameworks, ISO 9000 Models, SEI-CMM Model.
III	Software Design: Basic Concept of Software Design, Architectural Design, Low Level Design: Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design. Software Measurement and Metrics: Various Size Oriented Measures: Halestead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures: Control Flow Graphs.
IV	Software Testing: Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-Down and Bottom-Up Testing Strategies: Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products. Static Testing Strategies: Formal Technical Reviews (Peer Reviews), Walk Through, Code Inspection, Compliance with Design and Coding Standards.
V	Software Maintenance and Software Project Management, Software as an Evolutionary Entity, Need for Maintenance, Categories of Maintenance: Preventive, Corrective and Perfective Maintenance, Cost of Maintenance, Software Re-Engineering, Reverse Engineering. Software Configuration Management Activities, Change Control Process, Software Version Control, An Overview of CASE Tools. Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO), Resource Allocation Models, Software Risk Analysis and Management.

References:

1. Software Engineering: A Practitioner's Approach, Pressman Roger, TMH, 2009.
2. An Integrated Approach to Software Engineering, Pankaj Jalote. Narosa Pub, 2014.
3. Software Engineering Concepts: Richard Fairly, Tata McGraw Hill, 2015.

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COMPUTER GRAPHICS
(TCS504)

Objective: The goal of subject is to provide the students a broad exposure to the computer graphics field in order to prepare for follow-on study.

Unit	Topic
I	Graphics Display Devices, Interactive Devices, Line and Circle Plotting Using Breshenhams"s Algorithm Windowing and Cliping, Suterland Cohen Approach, Curus Back Method, Midpoint Subdivision Algorithm, Curve Drawing, Hermit Polynomial.
II	Bezier Curves, B-Splines, Picture Transformation, Scaling Mirror Images, 2D & 3D Graphics, Coordinate System, 3D Transformation, Rotation about an Arbitrary Axis.
III	Orthogonal Projection, Multiple Views, Isometric Projections, Perspective projections, 3D Clipping, Hidden Surface Removal, Curved Surface Generation, Generation of Solids, Sweeps Method, Interpolation, Illumination model, Ray Tracing.
IV	Shading, Transparency, Shadows, Textures Colors, CGS Modelling, Graphic Standards GKS, PHIGS, Animation Fundamentals-Control and Sequencing, Creating, Sealing and Saving Frames, Synchronising Frames, Audio-Video Editing, Implementation in C++.
V	Computational Geometry: Complexity notation, geometric data structures, geometric searching, point location problems, range search queries, Convex hull, Gaham's scan, Jarvis March, Quick Hul, Gift Wrapping, Beneath- beyond method, Proximity lower bounds, closest pair, Voronoi diagram, Triangulation, Art gallery problem, use of duality.

References:

1. Donald Hearn and M. Pauline Baker, " Computer Graphics", PHI, 2016.
2. Steven Harrington, "Computer Graphics: A Programming Approach", TMH, 1987.
3. Foley James D, "Computer Graphics", AW, 2014

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FORMAL LANGUAGE & AUTOMATA THEORY
(TCS505)

Objective: Develop a formal notation for strings, languages and machines and Design finite automata to accept a set of strings of a language.

Unit	Topic
I	**Introduction:** Alphabets, Strings and Languages; Automata and Grammars, Chomsky's classification. Finite Automata: Deterministic finite Automata (DFA)-Formal Definition, Simplified notation: State transition graph, Transition table, Language of DFA, Nondeterministic finite Automata (NFA), NFA with epsilon transition, Language of NFA, Equivalence of NFA and DFA, Minimization of Finite Automata, Distinguishing one string from other, Myhill-Nerode Theorem.
II	**Regular Expression:** Regular expression (RE), Definition, Operators of regular expression and their precedence, Algebraic laws for Regular expressions, Kleen's Theorem, Regular expression to FA, DFA to Regular expression, Arden Theorem, Regular Languages and Its Properties: Non Regular Languages, Pumping Lemma for regular Languages. Application of Pumping Lemma, Closure properties of Regular Languages, Decision properties of Regular Languages, FA with output: Moore and Mealy machine, Equivalence of Moore and Mealy Machine, Applications and Limitation of FA.
III	**Context free grammar (CFG) and Context Free Languages (CFL):** Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammer, Inherent ambiguity, Ambiguous to Unambiguous CFG, Useless symbols, Simplification of CFGs, Normal forms for CFGs: CNF and GNF, Closure properties of CFLs, Decision Properties of CFLs: Emptiness, Finiteness and Memership, Pumping lemma for CFLs.
IV	**Push Down Automata (PDA):** Description and definition, Instantaneous Description, Language of PDA, Acceptance by Final state, Acceptance by empty stack, Deterministic PDA, Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA.
V	**Turing machines (TM):** Basic model, definition and representation, Instantaneous Description, Language acceptance by TM, Variants of Turing Machine, TM as Computer of Integer functions, Universal TM, Church's Thesis. Recursive and Recursively Enumerable languages. Undecidability: Halting problem, Introduction to Undecidability, Undecidable problems about TMs. Post correspondence problem (PCP), Modified PCP, Introduction to recursive function theory.

References:

1. J Hopcroft, JD Ullman, R Motwani, Introduction to Automata Theory, Languages and Computation, Pearson, 2006.
2. M Sipser, Introduction to the Theory of Computation, Thomson, 2006.

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CONSTITUTION OF INDIA
(Constitution of India, Professional Ethics and Human Rights)
TMC-502/TMC-602

Unit	Contents	No. of Hrs.
I	CONSTITUTION OF INDIA Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution, Preamble to the Indian Constitution, Fundamental Rights & its limitations.	8
II	FUNDAMENTAL DUTIES AND UNION EXECUTIVES Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister, Parliament, Supreme Court of India.	8
III	STATE LEGISLATURE AND ELECTORAL PROCESS State Executives – Governor Chief Minister, State Legislature, High Court of State, Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.	8
IV	HUMAN RIGHTS Special Provision for SC & ST, Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights –Meaning and Definitions, Legislation, Specific Themes in Human Rights- Working of National Human Rights Commission in India ,Powers and functions of Municipalities, Panchyats and Co – Operative.	8
V	PROFESIONAL ETHICS Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.	8

Reference Books:

1. Durga Das Basu: "Introduction to the Constitution on India", (Students Edn.) Prentice –Hall EEE, 19th / 20th Edn., 2001
2. Charles E. Haries, Michael S Pritchard and Michael J. Robins "Engineering Ethics" Thompson Asia, 2003-08-05.
3. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
4. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice –Hall of India Pvt. Ltd. New Delhi, 2004
5. Brij Kishore Sharma,"Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.

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ARTIFICIAL INTELLIGENCE LAB
(TCS551)

LIST OF EXPERIMENTS

1. Write a programme to conduct uninformed and informed search.
2. Write a programme to conduct game search.
3. Write a programme to construct a Bayesian network from given data.
4. Write a programme to infer from the Bayesian network.
5. Write a programme to run value and policy iteration in a grid world.
6. Write a programme to do reinforcement learning in a grid world.

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JAVA PROGRAMMING LAB
(TCS552)

LIST OF EXPERIMENTS

1. Write a program to display the default value of all primitive data types in Java.
2. Write a Java program to sort given list of numbers.
3. Write a Java program to implement linear search.
4. Write a Java program to implement binary search.
5. Write a java program to add two given matrices.
6. Write a java program to multiply two given matrices.
7. Write a java program for sorting a given list of names.
8. Write a java program that checks whether a given string is a palindrome or not.
9. Write a java program that performs call by value and call by reference.
10. Write a java program that illustrates the simple inheritance.
11. Write a java program that illustrates the multilevel inheritance.
12. Write a java program that demonstrates the difference between method overloading and overriding.
13. Write a java program that demonstrates the difference between method overloading and constructor overloading.
14. Write a java program that describes the exception handling mechanism.
15. Write a java program that uses try & catch blocks and check whether the given array size is negative or not.
16. Write a java program that describes the user defined exception.
17. Write a java program that illustrates the creation of threads by using runnable class.
18. Write a java program that illustrates the multiple inheritances by using interfaces.
19. Write a java program to create a package named p1, and implement this package in ex1 class.
20. Write a java program to create a package named my pack, and import it in circle class.
21. Write a java program that illustrates the example for abstract class.
22. Write a java program that describes the life cycle of an applet. - A java program to create a dialog box and menu. - A java program to create a grid layout control.
23. A java program to create a border layout control.
24. Write an Applet that creates a simple calculator.

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SOFTWARE ENGINEERING LAB
(TCS553)

LIST OF EXPERIMENTS

1. Introduction to Microsoft Project Professional.
2. Basic steps required to create project and prepare it for data entry (project tasks, sequence the tasks and estimate task duration).
3. Setting up a project [Eating Breakfast] and establish the basic constraints that project will use for its calculation. Analyze the project from different view [Gantt Chart, Network Diagram]
4. Setting up a project [Refurbishment of Workshop] and identifying relationship among the different task and subtask.
5. Setting up a project [Exam Cell Activities] and explain how to enter resources and specific information in Microsoft Project and resources to specific tasks.
6. Case Study: Project Windows 8 (Module works on windows Vista and now transform the module to work on Window 8).

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COMPUTER GRAPHICS LAB
(TCS554)

LIST OF EXPERIMENTS

1. Write a program to animate a bouncing ball using in built functions.
2. Write programs to draw Line, circle using DDA technique and polynomial equation.
3. Write programs to implement Mid point line, circle.
4. Write programs to implement Bresenham's line, circle.
5. Write programs to implement Flood-fill , boundary fill algorithm.
6. Write a program to implement scan line polygon fill algorithm.
7. Write a program to implement all the basic 2D-Transformations.
8. Write a program to implement cohen-sutherland line clipping algorithm.
9. Write a Program to implement sutherland-Hodgmn clipping algorithm.
10. Write a Program to implement Bezier curve.

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DR. SHAKUNTALA MISRA NATIONAL REHABILITATION UNIVERSITY
FACULTY OF ENGINEERING TECHNOLOGY,
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)

III Year: VI Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	TCS601	Computer Networks	3	0	0	20	10	30	70	100	3
2	TCS602	Compiler Design	3	1	0	20	10	30	70	100	4
3	TCS603	Python Programming	3	0	0	20	10	30	70	100	3
4	TCS604	Neural Network & Deep Learning	3	0	0	20	10	30	70	100	3
5	TCS061 - 064	Departmental Elective –I	3	0	0	20	10	30	70	100	3
6	THS601	Engineering Economics	2	0	0	20	10	30	70	100	2
PRACTICAL/DESIGN/DRAWING											
7	TCS651	Computer Networks Lab	0	0	2	0	30	30	70	100	1
8	TCS652	Compiler Design Lab	0	0	2	0	30	30	70	100	1
9	TCS653	Python Programming Lab	0	0	2	0	30	30	70	100	1
10	TCS654	Seminar	0	0	6	0	100	100	0	200	1
		Total	17	1	12					1000	22

The Summer Training (5-6 weeks) conducted during summer break after VI semester and will be assessed during VII Semester

Departmental Elective –I		
1	TCS061	Data Sciences
2	TCS062	Distributed System
3	TCS063	Data Mining and Warehousing
4	TCS064	Machine Learning

L- Lecture
T -Tutorial
P-Practical
MST- Mid Semester Test
TA-Teacher's Assessment
SEE- Semester End Examination

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COMPUTER NETWORKS
(TCS601)

Objective: The objective of this course is to provide basic exposure to computer networks theory and implementations.

Unit	Topic
I	**Introduction:** Networks, Internet, Network Components, Network Categories, Applications of Computer Networks **Reference Models:** Concept of Layering, OSI Model, TCP/IP Protocol Suite, Functions of Layers **Physical Layer:** Transmission Mode, Physical Topology, Multiplexing, Transmission Media, Switching
II	**Data Link Layer:** Design Issues, Error Detection and Correction Techniques, Elementary Data Link Protocols, Sliding Window Protocols, Multiple Access Protocols, Ethernet, Connecting Devices
III	**Network Layer:** Logical addressing, IPv4 Addresses, NAT, IPv6 Addresses, Internet Protocol, IPv4, IPv6, Internetworking, Internet Control Protocols, Routing Algorithms, Distance Vector Routing, Link State Routing, Routing in the Internet
IV	**Transport Layer:** Process-to-Process Delivery, Transport Layer Protocols, UDP, User Datagram, TCP, TCP Segment, TCP Connection, Flow Control and Error Control, TCP Transmission Policy, Principles of Congestion Control, TCP Congestion Control, Quality of Service.
V	**Application Layer:** Principles of Network Applications, WWW and HTTP, Non-Persistent and Persistent Connections, Cookies, Web Caching, File Transfer, Remote Logging, Electronic Mail in the Internet, Domain Name System, Security: Introduction, Cryptography and Cryptanalysis, Public Key Cryptography Algorithms, RSA Algorithm, DES, Authentication and Authorization

References:

1. AS Tanenbaum, DJ Wetherall, Computer Networks, Prentice-Hall, 2010.
2. LL Peterson, BS Davie, Computer Networks: A Systems Approach, Morgan-Kauffman, 2011.
3. W Stallings, Cryptography and Network Security, Principles and Practice, Prentice-Hall, 2005.

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COMILER DESIGN
(TCS602)

Objective: Students will have a fair understanding of some standard passes in a general-purpose compiler.

Unit	Topic
I	**Introduction to Compiler**: Phases and passes, Bootstrapping, Finite state machines and regular expressions and their applications to lexical analysis, implementation of lexical analyzers,, LEX-compiler, Formal grammars and their application to syntax analysis,, ambiguity, The syntactic specification of programming languages: Context free grammars, derivation and parse trees, capabilities of CFG.
II	**Basic Parsing Techniques**: Parsers, Shift reduce parsing, operator precedence parsing, top down parsing, predictive parsers Automatic Construction of efficient Parsers: LR parsers, the canonical Collection of LR(0) items, constructing SLR parsing tables, constructing Canonical LR parsing tables, Constructing LALR parsing tables, using ambiguous grammars, an automatic parser generator, YACC tool.
III	**Syntax-directed Translation:** Syntax-directed Translation schemes, Intermediate code, postfix notation, Parse trees & syntax trees, three address code, quadruple & triples, Translation of simple statements and control flow statements, Type checking, Type conversions, Equivalence of type expressions, Overloading of functions and operations.
IV	**Symbol Tables**: Data structure for symbols tables, representing scope information. **Run-TimeAdministration:** Implementation of simple stack allocation scheme, storage allocation in block structured language. Error Detection & Recovery: Lexical Phase errors, syntactic phase errors semantic errors.
V	**Code Generation**: Design Issues, the Target Language. Addresses in the Target Code, Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Code Generator. Code optimization: Machine-Independent Optimizations, Loop optimization, DAG representation of basic blocks, value numbers and algebraic laws. Global Data-Flow analysis.

References:

1. K.D. Cooper, and Linda Torczon, Engineering a Compiler, Morgan Kaufmann, 2011.
2. K.C. Louden, Compiler Construction: Principles and Practice, Cengage Learning, 1997.
3. D. Brown, J. Levine, and T. Mason, LEX and YACC, O"Reilly Media, 1992.

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PYTHON PROGRAMMING
(TCS603)

Objective: Students will solve problems, explore real-world software development challenges, and create practical and contemporary applications.	
Unit	**Topic**
I	Introduction: Basic data types – Strings, Lists, Tuples – Lists and Tuples – Strings and Unicode strings Buffers – Dictionaries – Numbers – Type conversions – Files. Syntax rules: Indentation – Line structure – Block structure – Special objects.
II	Variables and namespaces: Variables – Multiple assignments – Assignments, references and copies of objects – Namespaces – Accessing namespaces. Control flow:. Conditionals – Loops – while – for – more about loops.
III	Functions: Operators – Order of evaluation – Object comparisons – dot operator – String formatting – Defining functions – Passing arguments to parameters – Reference arguments – Passing arguments by keywords – Default values of parameters – Variable number of parameters.
IV	Exceptions: General Mechanism – Python built-in exceptions – Raising exceptions – Defining exceptions . Modules and packages: Modules – Loading – Packages – Loading
V	Classes: Creating instances – Getting information on a class.

References:

1. Mark Lutz, David Ascher (2003) Learning Python. O'Reilly & Associates
2. Alan Gauld (2000) Learn To program Using Python Addison –Wesley

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NEURAL NETWORKS & DEEP LEARNING
(TCS604)

Objective: Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems.	
Unit	**Topic**
I	**Introduction:** Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques. **Feedforward neural network:** Artificial Neural Network, activation function, multi-layer neural network.
II	**Training Neural Network:** Risk minimization, loss function, backpropagation, regularization, model selection, and optimization. **Conditional Random Fields:** Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.
III	**Deep Learning:** Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.
IV	**Probabilistic Neural Network:** Hopfield Net, Boltzman machine, RBMs, Sigmoid net, Autoencoders. **Deep Learning research:** Object recognition, sparse coding, computer vision, natural language processing.
V	**Deep Learning Tools:** Caffe, Theano, Torch.

References:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016..
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.

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Engineering Economics

THS-501/THS-601

Unit	Contents	No. of Hrs.
I	**Definition of Economics** – Various definitions, Nature of Economic problem, Production possibility curve, Economic laws and their nature. Relation between Science, Engineering, Technology and Economics.Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility – its practical application and importance.	8
II	**Demand** :Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, measurement of elasticity of demand, factors effecting elasticity of demand, practical importance & applications of the concept of elasticity of demand.	8
III	**Meaning of production and factors of production;** Law of variable proportions, Returns to scale, Internal and External economies and diseconomies of scale, Break Even analysis.Various concepts of cost – Fixed cost, variable cost, average cost, marginal cost, money cost, real cost, opportunity cost. Shape of average cost, marginal cost, total cost etc. in short run and long run.	8
IV	**Meaning of Market,** Types of Market – Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition (Main features of these markets),Supply and Law of Supply, Role of Demand & Supply in Price Determination and effect of changes in demand and supply on prices.	8
V	**Nature and characteristics of Indian economy** (brief and elementary introduction), Privatization – meaning, merits and demerits. Globalisation of Indian economy – merits and demerits. Elementary Concepts of National Income, GDP, Inflation, Deflation.	8

References:

1. Premvir Kapoor, Sociology and Economics for Engineers, Khanna Publishing House (Edition 2018)
2. Salvatore D, "Principles of Microeconomics", Oxford University Press.
3. Koutsoyiannis A, "Modern Microeconomic", Macmillan Education Ltd.
4. Dwivedi DN, "Principles of Microeconomics", Pearson Education.
5. Cowell, FA, "Microeconomic Principles and Analysis", Oxford University Press.

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COMPUTER NETWORKS LAB
(TCS651)

LIST OF EXPERIMENTS

1. To learn basics of the packet tracer simulator tool.
2. Write a program in C to implement bit stuffing and character stuffing.
3. To connect the computers in Local Area Network and to detect collision of packets.
4. To configure DHCP and DNS server for a given network in packet tracer simulator tool.
5. Write a C program to get the MAC or Physical address of the system using ARP (Address Resolution Protocol) and to subnet a given network according to the requirements in packet tracer simulator tool. .
6. To configure router using command line. Also observe the datagram formats in packet tracer simulator tool.
7. To configure NAT for a given network in packet tracer simulator tool.
8. Write a program to implement TCP & UDP Sockets.
9. Write a C program to transmit a character, a string and a file from one computer to another using RS-232 cable and to configure static routing in packet tracer simulator tool.
10. To configure dynamic routing protocols in packet tracer simulator tool.

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COMILER DESIGN LAB
(TCS652)

LIST OF EXPERIMENTS

1. Write a program to check whether a string belongs to the grammar or not.
2. Practice of Lex of Compiler writing.
3. Write a LEX program to count number of printf and scanf from a given c program file and replace them with write and read respectively.
4. Write a program to check whether a grammar is left recursive and remove left recursion.
5. Write a program to remove left factoring
6. Write a program to compute FIRST and FOLLOW of non-terminals.
7. Write a program to check whether a grammar is Operator precedent. .
8. Practice of Yacc of Compiler writing.
9. Write a YACC program to recognize the grammer[$a^n b / n>0$] . Test whether the following string belongs to this grammer.
10. Write a YACC & LEX program to identify valid if and if-else statement.

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PYTHON PROGRAMMING LAB
(TCS653)

LIST OF EXPERIMENTS

1) Write a Python program to find GCD of two numbers.
2) Write a Python Program to find the square root of a number by Newton's Method
3) Write a Python program to find the exponentiation of a number.
4) Write a Python Program to find the maximum from a list of numbers.
5) write a Python Program to perform Linear Search
6) write a Python Program to perform Binary Search
7) Write a Python Program to perform selection sort.
8) Write a Python Program to perform insertion sort.
9) Write a Python Program to perform Merge sort.
10) Write a Python program to find first n prime numbers.
11) Write a Python program to multiply matrices.

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DEPARTMENTAL ELECTIVE – I
(TCS061 to TCS064)

DATA SCIENCES
(TCS061)

Objective: The objective of this course is to impart necessary knowledge of the mathematical foundations needed for data science and develop programming skills required to build data science applications.

Unit	Topic
I	**Introduction:** Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting
II	**Introduction to Programming Tools for Data Science:** Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK , Visualizing Data: Bar Charts, Line Charts, Scatterplots , Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction
III	**Mathematical Foundations:** Linear Algebra: Vectors, Matrices, , Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation , Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem , Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, Phacking, Bayesian Inference
IV	**Machine Learning:** Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks- Learning And Generalization,
V	**Case Studies of Data Science Application:** Weather forecasting, Stock market prediction, Object recognition, Real Time Sentiment Analysis.

References:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
3. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.
4. Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi.
5. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi.
6. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi.
7. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers

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DISTRIBUTED SYSTEM
(TCS062)

Objective: To introduce the fundamentals of distributed computer systems, assuming the availability of facilities for data transmission.	
Unit	**Topic**
I	**Characterization of Distributed Systems.** Examples of distributed systems, Resource sharing on the web, challenges. **System Models:** Introduction, Architectural model fundamental model. **Networking and Internetworking:** Types of network, Network Principles, Internet Protocols. Ethernet, WiFi, Bluetooth and ATM.
II	**Interprocess Communication:** API for the internet protocols, External data representation and marshalling, client-server communication, Group communication, Interprocess communication in Unix. **Distributed Objects and Remote Invocation:** Communication between distributed objects, Remote Procedure calls, Events and notifications, Java RMI, Sun network File system.
III	**Operating System Support:** Operating system Layer, Protection, Processes and threads, Communication and Invocation, Operating system Architecture. **Security:** Overview of security techniques, Cryptographic algorithms, Digital signatures, Cryptography pragmatics.
IV	**Time and Global states:** Clocks, events and process states, synchronizing physical clocks, logical time and logical clocks. **Coordination and agreement:** Distributed mutual exclusion, elections, multicast communication, consensus and related problems.
V	**Transactions and concurrency control:** Transactions, Nested transactions, Locks, Optimistic Concurrency control, Timestamp ordering, Comparison of methods for concurrency control. **Distributed Transactions:** Flat and Nested transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery.

References:

1. Distributed Systems, S. Ghosh, Chapman & Hall/CRC, Taylor & Francis Group,2010.
2. Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, Pearson Education, 2012

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DATA MINING AND WAREHOUSING
(TCS063)

Objective: To familiarize the students with advanced databases and techniques of retrieving and storing information.

Unit	Topic
I	Introduction to Data Mining: Definition, Features, Classification of Data Mining, Applications and trends in data mining, Knowledge Discovery Process, Data Mining Techniques. Data Pre-processing: Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction Data Mining Functionalities: Mining Frequent Patterns, Associations and Correlations, Classification and Prediction, Cluster Analysis, Outlier Analysis.
II	Introduction to Data warehouse: Data warehousing concepts, Multidimensional Data Model, Architecture, Implementation, Components of Data warehouse, Integration of a Data Mining with Data Warehouse, Data Cube Computation and Data Generalization.
III	Classification and Predication: Decision tree induction, Bayesian Classification, Rule case Classification, Classification by Back propagation, Genetic Algorithm, Predication – Linear and Non- Linear Regression.
IV	Cluster Analysis: Types of Data in Cluster Analysis, Clustering Methods - Partitioning, Hierarchical, Density – Based, Grid – Based, Model – based, Outlier Analysis.
V	On - Line Analytical Processing: Introduction, OLAP Server, MOLAP, ROLAP, HOLAP, Managed Query Environment, Features of OLAP, Comparison between OLTP and OLAP, Testing the Data Warehouse, Data Warehouse Recovery Models..

References:

1. Sam Anahory & Dennis Murray: Data Warehousing in the real world, 2002.
2. Ali ABM Shawkat and Wasimi Saleh A: Data Mining; Method and Technique, Cengage Publication, 2007.
3. S. Rizzi & M. Golfarelli: Data Warehouse Design; Modern Principles and Methodologies, Tata McGraw-Hill Education, 2009.

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MACHINE LEARNING
(TCS064)

Objective: To understand the basic building blocks and general principles that allow one to design machine learning algorithms.

Unit	Topic
I	Basic Concepts, Introduction to Machine Learning, Applications of ML, Design Perspective and Issues in ML, Supervised, Unsupervised, Semi-supervised learning with applications and issues, A Formal Learning Model, The Runtime of Learning.
II	Model (or hypothesis) representation, decision boundary, cost function, gradient descent, regularization, Diagnostic: debugging a learning algorithm, evaluating a hypothesis (Model selection), training/validating/testing procedures, diagnosing bias versus variance and vice versa, regularization and bias/variance, learning curves, Accuracy and Error measures: classifier accuracy measures, predictor error measure, evaluating the accuracy of a classifier or predictor, Confusion metric, precision, recall, tradeoff between both, accuracy.
III	Decision Tree : representation, hypothesis, issues in Decision Tree Learning, Pruning, Rule extraction from Tree, Learning rules from Data, Probabilistic classifier: Bayes rule, Maximum Likelihood Estimation, case study, Support Vector Machine, Nearest Neighbor.
IV	Clustering: Unsupervised learning technique, Similarity and Distance Measures, k-means and k-medoids algorithm, optimization objective, random initialization, choosing value of k, EM algorithm Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, Graphical Models, Combining Multiple Learners.
V	Reinforcement Learning: Elements of Reinforcement Learning, Model-Based Learning, Temporal Difference Learning, Generalization, Design and Analysis of Machine Learning Experiments.

References:

1. Ethem Alpaydin, Introduction to Machine Learning, PHI, 2015.
2. H. Witten and E. Frank, Data Mining: Practical Machine Learning Tools and TechniquesMorgan Kaufmann2005.
3. Tom Mitchell, Machine Learning, McGraw-Hill, 1997.

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DR. SHAKUNTALA MISRA NATIONAL REHABILITATION UNIVERSITY

FACULTY OF ENGINEERING TECHNOLOGY,

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)

IV Year: VII Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	TCS701	Digital Image Processing	3	1	0	20	10	30	70	100	4
2	OE071-074	Open Elective - I	3	0	0	20	10	30	70	100	3
3	TCS071 - 074	Departmental Elective-II	3	0	0	20	10	30	70	100	3
4	TCS075 - 078	Departmental Elective-III	3	0	0	20	10	30	70	100	3
PRACTICAL/DESIGN/DRAWING											
5	TCS751	Digital Image Processing Lab	0	0	2	0	30	30	70	100	1
6	TCS752	Industrial Training	0	0	2	0	30	30	70	100	1
7	TCS753	Project - II	0	0	10	0	400	400	0	400	5
		Total	12	1	14					1000	20

Open Elective - I

1	TOE071	Renewable Energy Sources Development Technology
2	TOE072	Global Positioning System and its Applications
3	TOE073	Data Base Management System and Data Mining
4	TOE074	Introduction To Robotics& Bionics
5	TOE075	Entrepreneurship Development
6	TOE076	Quality Management

Departmental Elective –II

1	TCS071	Quantum Computing
2	TCS072	Embedded System
3	TCS073	Speech and Natural Language Processing
4	TCS074	Cloud Computing

Departmental Elective –III

1	TCS075	Internet of Things (IoT)
2	TCS076	Cluster Computing
3	TCS077	Parallel Algorithm
4	TCS078	Human Computer Interaction

L- Lecture

T -Tutorial

P-Practical

MST- Mid Semester Test

TA-Teacher's Assessment

SEE- Semester End Examination

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DIGITAL IMAGE PROCESSING
(TCS701)

Objective: The purpose of this course is to impart knowledge on various Digital Image Processing Techniques and their Applications.

Unit	Topic
I	**Introduction and Fundamentals:** Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization. Image Enhancement in Spatial Domain: Introduction; Basic Gray Level Functions – Piecewise-Linear Transformation Functions: Contrast Stretching; Histogram Specification; Histogram Equalization; Local Enhancement; Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging; Basics of Spatial Filtering; Smoothing - Mean filter, Ordered Statistic Filter; Sharpening – The Laplacian.
II	**Image Enhancement in Frequency Domain:** Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Filters – Low-pass, High-pass; Correspondence Between Filtering in Spatial and Frequency Domain; Smoothing Frequency Domain Filters – Gaussian Low-pass Filters; Sharpening Frequency Domain Filters – Gaussian High-pass Filters; Homomorphic Filtering.
III	**Image Restoration:** A Model of Restoration Process, Noise Models, Restoration in the presence of Noise only-Spatial Filtering – Mean Filters; Arithmetic Mean filter, Geometric Mean Filter, Order Statistic Filters – Median Filter, Max and Min filters; Periodic Noise Reduction by Frequency Domain Filtering– Band-pass Filters; Minimum Mean-square Error Restoration.
IV	**Color Image Processing:** Color Fundamentals, Color Models, Converting Colors to different models, Color Transformation, Smoothing and Sharpening, Color Segmentation. Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening.
V	**Image Compression:** Fundamentals, image compression models, Compression methods: Huffman coding, Golomb Coding, Arithmetic Coding, LZW coding, Run-Length coding, Symbol based coding.error-free compression, lossy predictive coding, image compression standards. **Image Segmentation:**Fundamentals, Point, Line and edge detection. Thresholding: foundation, Basic Global Thresholding, Otsu's Method, Image smoothing to improve global thresholding.

References:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Tata McGraw Hill Pvt. Ltd, 2016.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning, 2010 .

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DIGITAL IMAGE PROCESSING LAB
(TCS751)

LIST OF EXPERIMENTS

1. Acquisition and Display of color and Grayscale Images, Conversion of Color to Grayscale using Averaging, Grayscale to Bitmap Image using Thresholding
2. Implement the spatial image enhancement functions on a bitmap image –
   (a) Mirroring (Inversion) (b) Rotation (Clockwise) (c) Enlargement (Double Size)
3. Implementation of Histogram Equalization in Grayscale Image.
4. Image Enhancement in Spatial Domain- Smoothing and Sharpening.
5. Image Enhancement in Frequency Domain- Fourier Transform, Gaussian Highpass Filters, Homomorphic Filtering.
6. Image Restoration: Spatial Filtering and Statistic Filters.
7. Color Image Processing: RGB to HSI conversion, Segmentation.
8. Morphological Image Processing- Dilation and Erosion, Opening and Closing, Thinning, Thickening.
9. Image Compression: error-free compression, lossy predictive coding
10. Segmentation- Edge Detection, Line Detection. Multi-level Thresholding, Local Thresholding.

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DEPARTMENTAL ELECTIVE – II
(TCS071 to TCS074)

QUANTUM COMPUTING
(TCS071)

Objective: Ability to apply and expand quantitaty techniques in computing.	
Unit	**Topic**
I	Fundament Cpncepts: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.
II	Quantum Computation: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.
III	Quantum Computers: Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance.
IV	Quantum Informations: Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.
V	Quantum Correction: Introduction, Shor code, Theory of Quantum Error – Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource.

References:

1. Computing since Democritus by Scott Aaronson, 2014.
2. Computer Science: An Introduction by N. David Mermin, 2006.
3. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists, 2008.

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EMBEDDED SYSTEM
(TCS072)

Objective: To introduce the basic concepts of Embedded Systems and the various techniques used for Embedded Systems with real time examples.	
Unit	**Topic**
I	Hardware Concepts -Application and characteristics of embedded systems, Overview of Processors and hardware Units in an embedded system, General purpose processors, Microcontrollers: 8051.
II	Application- Specific Circuits (ASICs), ASIP, FPGA, ARM-based System on a Chip (SoC), Network on Chip (NoC), Levels of hardware modelling, Verilog, Sensors, A/D-D/A converters, Actuators, Interfacing using RS-232, UART, USB, I2C, CAN bus, Flexray, SRAM and DRAM, Flash memory.
III	Real-Time Operating Systems- Real-Time Task Scheduling: Some important concepts, Types of real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA).
IV	Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix-based Real-time operating systems, POSIX-RT, A survey of contemporary Real- time operating systems, Microkernelbased systems, Benchmarking real-time systems.
V	Embedded Application Development - UML 2.0, State charts, General language characteristics, MISRA C, Hardware/Software Co- design, Hardware/software partitioning, Testing embedded systems, Design for testability and Self-test.

References:

1. Embedded Systems Design – A Unified Hardware /Software Introduction, by Frank Vahid and Tony Givargis, John Wiley, 1999.
2. An Embedded Software Primer, by David E.Simon, Pearson Education Asia, 1999.

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SPEECH AND NATURAL LANGUAGE PROCESSING
(TCS073)

Objective: To teach how to design, code, debug and document programs using techniques of good programming style.	
Unit	**Topic**
I	Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.
II	Introduction to semantics and knowledge representation, Some applications like machine translation, database interface.
III	Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.
IV	Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.
V	Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

References:

1. Akshar Bharti, Vineet Chaitanya and Rajeev Sangal "NLP: A Paninian Perspective", PHI, 1994.
2. James Allen "Natural Language Understanding" Pearson, 1994 .

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CLOUD COMPUTING
(TCS074)

Objective: This module gives students the skills and knowledge to understand how Cloud Computing Architecture can enable transformation, business development and agility in an organization. It also provide the concept of cloud security system and cloud infrastructure.

Unit	Topic
I	Introduction - Shift from distributed computing to cloud computing; principles, and characteristics of cloud computing- IaaS, PaaS, SaaS; service oriented computing and cloud environment.
II	Cloud Computing Technology - Client systems, Networks, server systems andsecurity from services perspectives; Accessing the cloud with platforms and applications; cloud storage.
III	Working with Cloud- Infrastructure as a Service – conceptual model and working Platform as a Service – conceptual model and functionalities Software as a Service – conceptual model and working Technologies and Trends in Service provisioning with clouds.
IV	Using Cloud Services- Cloud collaborative applications and services – technology, applications and case studies with calendars, schedulers and event management; cloud applications in project management.
V	Case studies-Microsoft Azure, Google App Engine and Open source clouds-Open-Nebula and Eucalyptus , Current trends and research.

References:

1. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications, Cambridge, 2010
2. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, 2012
3. Dimitris N. Chorafas, Cloud Computing Strategies, 2011.

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DEPARTMENTAL ELECTIVE – III
(TCS075 to TCS078)

INTERNET OF THINGS (IoT)
(TCS075)

Objective: The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-life IoT based projects.

Unit	Topic
I	Introduction - Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation
II	Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.
III	Elements of IoT: Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components-Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.
IV	IoT Application Development: Solution framework for IoT applications-Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.
V	IoT Case Studies: IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

References:

1. Vijay Madisetti, Arshdeep Bahga, Internet of Things, "A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
7. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media

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CLUSTER COMPUTING
(TCS07)

Objective: This course teaches solving large scale science, engineering, and commercial applications.

Unit	Topic
I	Basic concepts in Distributed Systems: Notion of time Distributed Mutual exclusion, Consensus, Failure models Paradigms for process interaction in distributed programs, Programming Paradigms, Shared memory, Message passing, Workflows.
II	Introduction to Cluster Computing, Cluster Middleware: An Introduction, Early Cluster Architectures and High Throughput Computing Clusters, Networking, Protocols and I/O for Clusters, Setting Up and Administering a Cluster.
III	Cluster Technology for High Availability, Performance Models and Simulation, Process Scheduling, Load Sharing and Load Balancing, Distributed Shared Memory.
IV	Introduction to Grid Architecture, Characterization of Grid, and Grid related standard bodies, Grid types, Topologies, Components and Layers, Comparison with other approaches.
V	System Infrastructure, Traditional paradigms for distributed computing, Web Services, Grid standards: OGSA and WSRF, Case Studies of Cluster Systems: Beowulf, COMPaS, NanoS and PARAM.

References:

1. High Performance Cluster Computing: Architectures and Systems, Prentice Hall, 1999.
2. Grid and Cluster Computing, Prabhu C.S.R, PHI Learning Private Limited, 2008.

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PARALLEL ALGORITHM
(TCS077)

Objective: To acquaint the students with the various algorithms techniques.	
Unit	**Topic**
I	Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.
II	Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost- optimality, an example of illustrate Costoptimal algorithms- such as summation, Min/Max on various models.
III	Parallel Sorting Networks, Parallel Merging Algorithms on on CREW/EREW/MCC, Parallel Sorting Networks CREW/EREW/MCC/, linear array.
IV	Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.
V	Graph Algorithms - Connected Graphs, search and traversal, Combinatorial Algorithms-Permutation, Combinations, Derrangements.

References:

1. M.J. Quinn, "Designing Efficient Algorithms for Parallel Computer", McGrawHill, 1994.
2. S.G. Akl, "Design and Analysis of Parallel Algorithms", Prentice Hall, 1989.

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HUMAN COMPUTER INTERFACE
(TCS078)

Objective: The purpose of this course is the study, planning and design of the interaction between people and computers.

Unit	Topic
I	Introduction: The human, The computer, The interaction, Paradigms, Usability of Interactive Systems, Guidelines, Principles, and Theories.
II	Design Process- Interaction design basics, HCI in the software process, Design rules, Implementation support, Evaluation techniques, Universal design, User support.
III	Models and Theories Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models,Task analysis, Dialogue notations and design, Models of the system, Modelling rich interaction.
IV	Interaction Styles- Direct Manipulation and Virtual Environments, Menu Selection, Form Filling and Dialog Boxes, Command and Natural Languages, Interaction Devices, Collaboration and Social Media Participation.
V	Design Issues- Quality of Service, Balancing Function and Fashion, User Documentation and Online Help, Information Search, Information Visualization, Outside the Box- Group ware,Ubiquitous computing and augmented realities, Hypertext, multimedia, and the world wide web.

References:

1,Human Computer Interaction by Alan Dix, Janet Finlay , Pearson Education, 2004.

2. Designing the User Interface - Strategies for Effective Human Computer Interaction, by Ben Shneiderman, Pearson Education, 2001.

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DR. SHAKUNTALA MISRA NATIONAL REHABILITATION UNIVERSITY
FACULTY OF ENGINEERING TECHNOLOGY,
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

STUDY & EVALUATION SCHEME

B.Tech. (CSE)
IV Year: VIII Semester

S.No.	Paper Code	Paper Name	L	T	P	Sessional			SEE	Paper Total	Credit
						MST	TA	Total			
THEORY SUBJECT											
1	OE081-084	Open Elective - II/MOOCs	3	0	0	20	10	30	70	100	3
2	TCS081 - 084	Elective-IV/MOOCs	3	0	0	20	10	30	70	100	3
3	TCS085 - 088	Elective-V/MOOCs	3	0	0	20	10	30	70	100	3
PRACTICAL/DESIGN/DRAWING											
5	TCS851	Project - II	0	0	18	0	700	700	0	700	9
		Total	9	0	18					1000	18
Massive Open Online Course (MOOC)		The students can register for these courses through NPTEL directlty as per the course offering in Odd/Even Semester at NPTEL. After successful completion of these Moocs course the students, shall, provide their successful completion NPTEL certificate to the Department.									

Open Elective - II

1	TOE081	Disaster Management
2	TOE082	Cloud Computing
3	TOE083	Project Management
4	TOE084	Operation Research
5	TOE085	Introduction to Bio-Technology
6	TOE086	Small Hydro Power Development

Departmental Elective –IV

1	TCS081	Cryptography & Network Security
2	TCS082	Real Time System
3	TCS083	Pattern Recognition
4	TCS084	Service Oriented

Departmental Elective –V

1	TCS085	Semantic Web and Web Services
2	TCS086	Big Data
3	TCS087	Blockchain
4	TCS088	Virtual Reality

L- Lecture
T -Tutorial
P-Practical
MST- Mid Semester Test
TA-Teacher's Assessment
SEE- Semester End Examination

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DEPARTMENTAL ELECTIVE – IV
(TCS081 – TCS084)
CRYPTOGRAPHY & NETWORK SECURITY
(TCS081)

Objective: The objective of this course is to Discover software bugs that pose cyber security threats, explain and recreate exploits of such bugs in realizing a cyber attack on such software, and explain how to fix the bugs to mitigate such threats.

Unit	Topic
I	**Introduction:** Security Goals, Security Attacks (Interruption, Intereception, Modification and Fabrication), Security Services and Mechanisms, A model for Internetwork Security, Euclidian Algorithm, Modular operator, Congruence, Additive invers, Multiplicative Inverse, Cryptanalysis, Cipher and Types of Cipher, Substitution Cipher, Caeser Cipher, Affine Cipher, Mono-alphabetic and Polyalphabetic cipher.
II	**Symmetric key and Encryption:** Groups and Applications, Modern Block Ciphers, Component of Modern Bloch Ciphers, D Boxes, Straight D Boxes, Modern Stream ciphers, Encryption, Conventional Encryption Principles & Algorithms, Data Encryption Standard (DES), Des Structure, DES Function, DES Algorithm and key generation, Security of DES, Advanced Encryption Standard(AES), Criteria, Round Data Unit, Algorithm, Analysis of AES,RC4.
III	**Cryptography:** Public key and Private key in Cryptography, Role of public key in cryptography, Cipher, Types of Cipher, Mode of Operation, Cryptography Algorithms (RSA, RABIN, ELGAMAL, Diffie-Hellman, ECC), Key Distribution, Approaches of Message Authentication, Hash Functions in cryptography.
IV	**Email and Web Security:** Pretty Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).
V	**Network Security:** Intruders, Viruses and related threats, Virus Countermeasures, Firewall Design principles, Trusted Systems, Intrusion Detection Systems.

References;

1. Vincent LeVeque: Information Security: A Strategic Approach, Wiley Publication, 2007 .
2. Saurabh Sharma: Information Security and cyber Law, Vikas Publication, 2011.

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REAL TIME SYSTEM
(TCS082)

Objective: Real-time computer systems for the monitoring and control of laboratory and industrial processes are studied and implemented.	
Unit	Topic
I	Introduction To Real-Time Computing: Characterizing Real – Time System & Task; Performance Measures of Real Time System, Estimation of Program Run Time, Real- Time System Design: Hardware Requirement, System Development Cycle.
II	Data Transfer Techniques, Synchronous & Asynchronous Data Communication, Standard Interface. Task Assignment And Scheduling: Priority Scheduling, Scheduling with Fixed Priority Dynamic Priority Scheduling.
III	Real-Time Programming Language & Tool: Desired Language Characteristics, Data Typing, Control Structure, Run Time Error- Handling, Overloading & Generics, Runtime Support, Real-Time Databases.
IV	Real-Time Communication Language Algorithm: Fault Tolerance Techniques, Causes of Failure, Fault Type, Fault Detection, Redundancy.
V	Integrated Failure Handling Reliability Evaluation Techniques: Parameter Values, Reliability Model For Hardware Redundancy, Software Error Model and Clock Synchronization.

References:

1. Real Time System: by C.M. Krishna & K.G. Shen- Mc Graw Hill, 1997.
2. Real-Time Systems: Design Principles for Distributed Embedded Applications by Kopetz, Hermann, Springer, 2011.

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PATTERN RECOGNITION
(TCS083)

Objective: To understand the basic building blocks and general principles that allows one to design pattern learning algorithms.	
Unit	**Topic**
I	Basics of pattern recognition, Design principles of pattern recognition system,Learning and adaptation, Pattern recognition approaches, Mathematical foundations – Linear algebra, Probability Theory, Expectation, mean and covariance, Normal distribution, multivariate normal densities, Chi squared test.
II	Statistical Patten Recognition: Bayesian Decision Theory, Classifiers, Normal density anddiscriminant functions.
III	Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameterestimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher Linear discriminant analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.
IV	Nonparametric Techniques: Density Estimation, Parzen Windows, K-Nearest NeighborEstimation, Nearest Neighbor Rule, Fuzzy classification.
V	Unsupervised Learning & Clustering: Criterion functions for clustering, Clustering Techniques:Iterative square - error partitional clustering – K means, agglomerative hierarchical clustering, Cluster validation.

References:

1. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2009.
2. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", Academic Press, 2008.

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SERVICE ORIENTED ARCHITECTURE
(TCS084)

Objective: This course describes the foundation of Service Oriented Architecture with its characteristics and advantages.	
Unit	**Topic**
I	Introduction: Distributed computing in the large, Motivations for composition, Challenges for composition, Web Services Architectures and Standards, Computing with Services , W3C, Fundamental of SOA, Characteristics of SOA, Comparing SOA to client-server and distributed internet architectures, Anatomy of SOA, How components in an SOA interrelate.
II	Enterprise Architectures and SOC Principles: Introduction, Integration versus interoperation , Model Driven Architecture , Concepts of Distributed Computing, XML, Use cases: Intra-enterprise and Inter-enterprise Interoperation, Application, Configuration, Dynamic Selection, Software Fault Tolerance.
III	Service Oriented Analysis Business-centric SOA – Deriving business, Services, Service modeling, Service Oriented Design; WSDL Basics, SOAP Basics, UDDI Basics, REST Basics, Difference between SOAP v/s REST, Web Service Basics Service Description, Messaging with SOAP, Message Exchange pattern, Coordination, Transaction, Business Activities, Orchestration, Choreography. Service layer Abstraction - Application Service Layer, Business Service Layer, Orchestration Service Layer.
IV	Service Composition: Service composition guidelines – Entity-centric business service design, Application service design, Task centric business, service design.
V	SOA Platform basics SOA support in J2EE: Java API for XML based web services (JAX-WS), Java architecture for XML binding (JAXB), Java API for XML Registries (JAXR), Java API for XML based RPC (JAXRPC), Web Services Interoperability Technologies (WSIT). SOA support in .NET: Common Language Runtime, ASP.NET web forms, ASP.NET web services, Web Services Enhancements (WSE).

References:

1. Munindar Singh & Michael Huhns, "Service Oriented Computing: Semantics, Processes, Agents", Wiley Publication, 2010.
2. Mark D Hansen, "SOA using Java™ Web Services", Prentice Hall Publication, 2007.
3. Dan Woods and Thomas Mattern, "Enterprise SOA Designing IT for Business Innovation" O'REILLY, 2006.
4. Shankar Kambhampaty, "Service-oriented Architecture for Enterprise Applications", John Wiley & Sons, 2008.

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DEPARTMENTAL ELECTIVE –V
(TCS085 – TCS088)
SEMANTIC WEB AND WEB SERVICES
(TCS085)

Objective: To introduce about the concepts of semantic web and its service based applications.

Unit	Topic
I	Introduction to Semantic Web: History of Semantic Web, goals and vision, problems, Semantic Web Technologies, Layered Approach, Syntactic vs semantic web, Applications of semantic web.
II	Architecture: XML with Document Type Definitions and Schema, addressing and querying XML documents, RDF (Resource Description Framework), basic idea and syntax, quering in RQL, URI.
III	Ontologies: Role of Ontology in intelligent information retrieval on web, OWL, Ontologies for different applications. Ontology engineering: constructing ontologies manually, reusing existing ontologies.
IV	Semantics: Kinds of semantics, use of semantics, Search Engines: Role of search Engines in intelligent retrieval of information on web, Semantic web browsers.
V	Logic and inference: examples of Monotonic rules: family relationships, monotonic rules: syntax and semantics, Non-monotonic rules: Motivation and syntax, Non-monotonic rule example: and Brokered Trade, Rule Mark-up XML: Monotonic and Non-Monotonic rules.

References:

1. Salam, A. F., ed. SemanticWeb Technologies and E-Business: Toward the Integrated Virtual Organization and Business Process Automation:. IGI Global, 2006.
2. Cardoso, Jorge, ed. Semantic Web Services: Theory, Tools and Applications: Theory, Tools and applications, 2007.

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BIG DATA
(TCS086)

Objective: Introduce the student to analytical tools and methods, which are currently used in bioinformatics as applied to biological information for human beings.	
Unit	**Topic**
I	Introduction - distributed file system–Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce.
II	Big Data – Apache Hadoop & Hadoop EcoSystem, Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce -, Data Serialization.
III	HDFS-Overview, Installation and Shell, Java API; Hive Architecture and Installation, Comparison with Traditional Database, HiveQL Querying Data, Sorting And Aggregating, Map Reduce Scripts, Joins & Sub queries, HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG, Zookeeper , how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.
IV	Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib, What is it?, Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, NewSQL.
V	Introduction to MongoDB key features, Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents , MongoDB Query Language.

References:

1. Boris lublinsky, Kevin t. Smith, AlexeyYakubovich, "Professional Hadoop Solutions", Wiley, 2013.
2. Chris Eaton,Dirk derooset al. , "Understanding Big data ", McGraw Hill, 2007.
3. Big Data and Analytics , Sima Acharya, Subhashini Chhellappan, Willey, 2007.
4. MongoDB in Action, Kyle Banker,Piter Bakkum , Shaun Verch, Dream tech Press, 2015.

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BLOCKCHAIN
(TCS087)

Objective: To introduce about the concepts of semantic web and its service based applications.

Unit	Topic
I	Introduction: Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Block chain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Crypto currency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Block chain Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic cryptocurrency.
II	Understanding Block chain with Crypto currency: Bitcoin and Block chain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.
III	Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, Hasheash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.
IV	Understanding Block chain for Enterprises: Permissioned Block chain: Permissioned model and use cases, Design issues for Permissioned block chains, Execute contracts, State machine replication, Overview of Consensus models for permissioned block chain- Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport-Shostak-Pease BFT Algorithm, BFT over Asynchronous systems, Enterprise application of Block chain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Block chain
V	Block chain application development: Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda

References:

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", O'Reilly, 2015
2. Josh Thompsons, "Block Chain: The Block Chain for Beginners- Guide to Block chain Technology and Leveraging Block Chain Programming"
3. Daniel Drescher, "Block Chain Basics", Apress; 1st edition, 2017
4. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
5. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing
6. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing

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VIRTUAL REALITY
(TCS088)

Objective: The objective of this course is to provide a detailed understanding of the concepts of Virtual Reality and its applications.

Unit	Topic
I	Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark 3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism-Stereographic image.
II	Geometric Modelling– Geometric Modelling: Introduction, From 2D to 3D, 3D space curves, 3D boundary representation Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.
III	Virtual Environment : Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object inbetweening, free from deformation, particle system. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.
IV	VR Hardware and Software: Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML
V	VR Applications : Introduction, Engineering, Entertainment, Science, Training. The Future: Virtual environment, modes of interaction

References:

1. John Vince, "Virtual Reality Systems ", Pearson Education Asia, 2007.
2. Anand R., "Augmented and Virtual Reality", Khanna Publishing House, Delhi.
3. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.
4. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Inter Science, 2nd Edition, 2006.
5. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann, 2008.

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